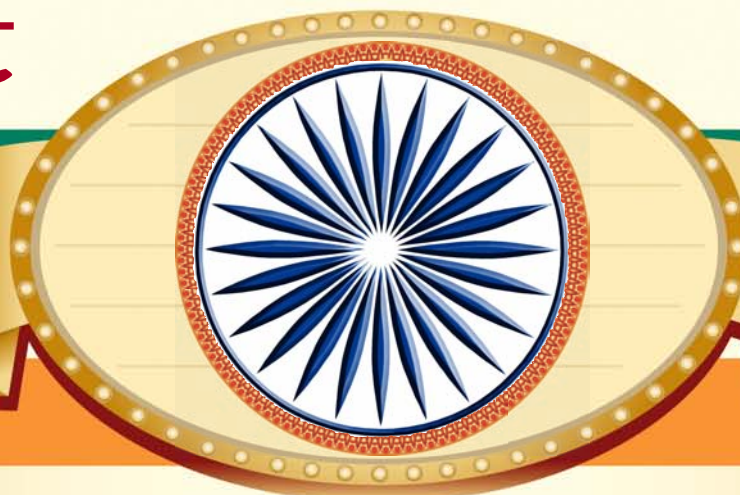


इंटरनेट

मानक



Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

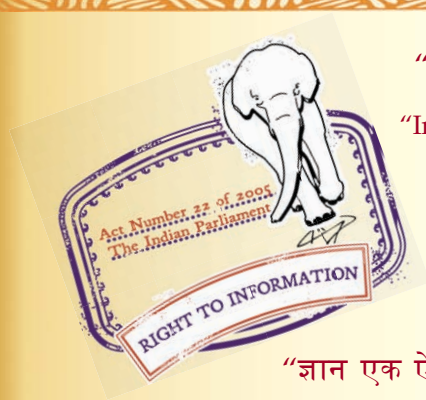
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

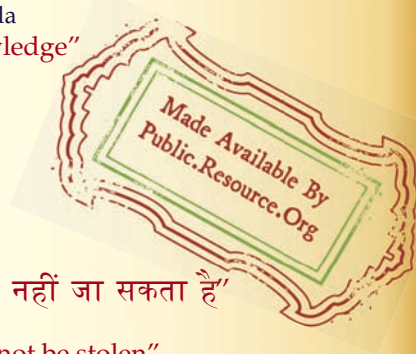
IS 13224 (1991): Automotive Vehicle Hydraulic Braking Systems - Master Cylinder - Performance Requirements [TED 4: Automotive Braking Systems]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



भारतीय मानक
स्वचालित वाहन — द्रवचालित ब्रेकिंग तंत्र —
मास्टर सिलिंडर — कार्यकारिता अपेक्षाएं

Indian Standard

**AUTOMOTIVE VEHICLES — HYDRAULIC
BRAKING SYSTEMS — MASTER CYLINDER —
PERFORMANCE REQUIREMENTS**

UDC 629'113-592'2-222 : 620'16

© BIS 1991

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110 002

November 1991

Price Group 3

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Braking System Sectional Committee had been approved by the Transport Engineering Division Council.

Braking system components play a vital role in the overall safety of a vehicle. This Indian Standard specifies the performance requirements for master cylinders used in a hydraulic braking system. This standard is one in the series of Indian Standards being developed for braking systems of road vehicles.

In the preparation of this Indian Standard considerable assistance has been derived from the following :

- SAE J 1153 — Hydraulic master cylinders for motor vehicle brakes — Test procedure**
- SAE J 1154 — Hydraulic master cylinders for motor vehicles brakes — Dimensions**
- JIS D 2603 — Hydraulic brake master cylinders for automobiles**

AMENDMENT NO. 1 MAY 1995
TO
IS 13224 : 1991 AUTOMOTIVE VEHICLES —
HYDRAULIC BRAKING SYSTEMS — MASTER
CYLINDER — PERFORMANCE REQUIREMENTS

[*Page 5, clause 6.10(a)*] — Substitute the following for the existing matter:

a) *Lip Diameter Change*

The minimum lip diameter change of master cylinder cups after the stroking test shall be greater than the master cylinder bore by the minimum dimensions as tabulated below:

<i>Diameter of Cups</i> mm	<i>Excess Over Bore Dia</i> mm
Up to 25.4	0.381
Over 25.4 up to 38.1	0.508
Over 38.1 up to 50.8	0.635

(TED 4)

Reprography Unit, BIS, New Delhi, India

Indian Standard

AUTOMOTIVE VEHICLES — HYDRAULIC BRAKING SYSTEMS — MASTER CYLINDER — PERFORMANCE REQUIREMENTS

1 SCOPE

1.1 This standard specifies the performance requirements and test methods for both single and dual output master cylinder assemblies used in hydraulically operated braking systems of automobiles.

1.2 This standard is applicable for new assemblies from production.

2 REFERENCES

IS No.	Title
8654 : 1986	Automotive hydraulic brake fluid, Heavy duty (<i>first revision</i>)
13225 : 1991	Automotive vehicles — Hydraulic braking systems — Rubber cups — Specification.

3 TERMINOLOGY

3.1 The master cylinder nomenclature are indicated in Fig. 1 and 2.

4 GENERAL REQUIREMENTS

4.1 The brake fluid used in the system shall conform to IS 8654 : 1986.

4.2 The metallic ports shall be given a suitable anti-corrosive treatment. The cylinder bore and the reservoir shall be free from dust, powder, and chippings. The sliding surfaces of the primary cup, pressure cup and secondary cup of the cylinder body shall be free from any harmful defects like dents, pin holes, rust etc. The valves and the valve seat shall be free of cracks and burns.

5 PERFORMANCE REQUIREMENTS

5.1 The following tests shall be carried out on the master cylinder assembly to assess the performance requirements.

- a) Full stroke test
- b) Venting
- c) Residual pressure
- d) Applied leakage
- e) Fluid displacement
- f) Strength
- g) Humidity
- h) Corrosion resistance in storage
- j) Reservoir Capacity and leakage
- k) Heat pressure stroking (for rubber cups)
- m) Low temperature performance (for rubber cups)

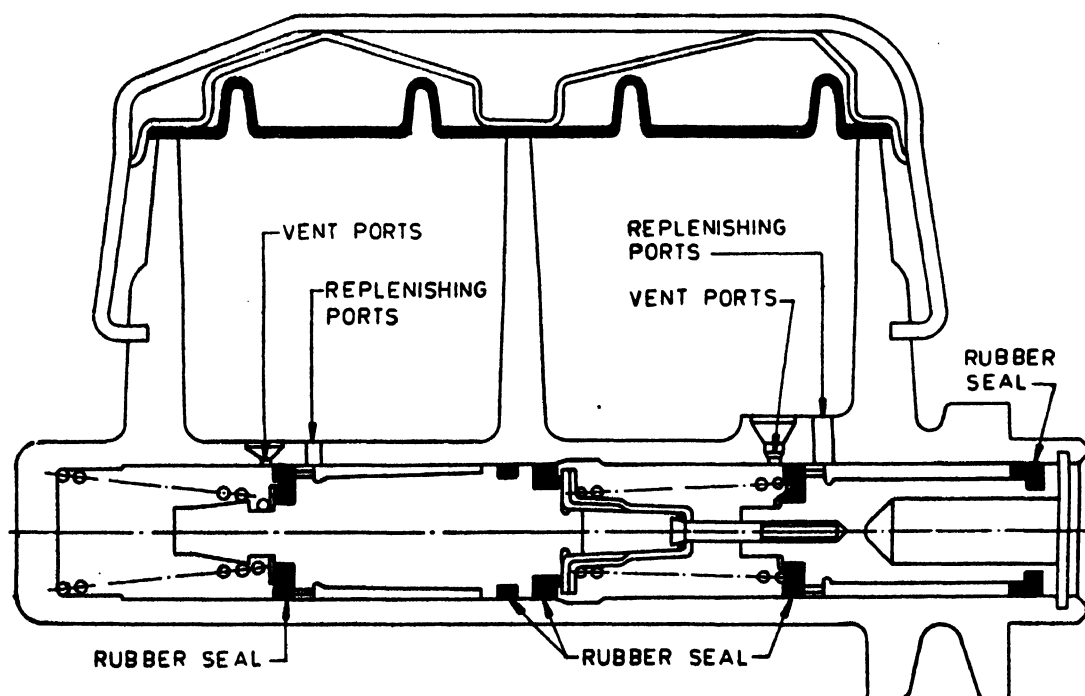


FIG. 1 MASTER CYLINDER NOMENCLATURE

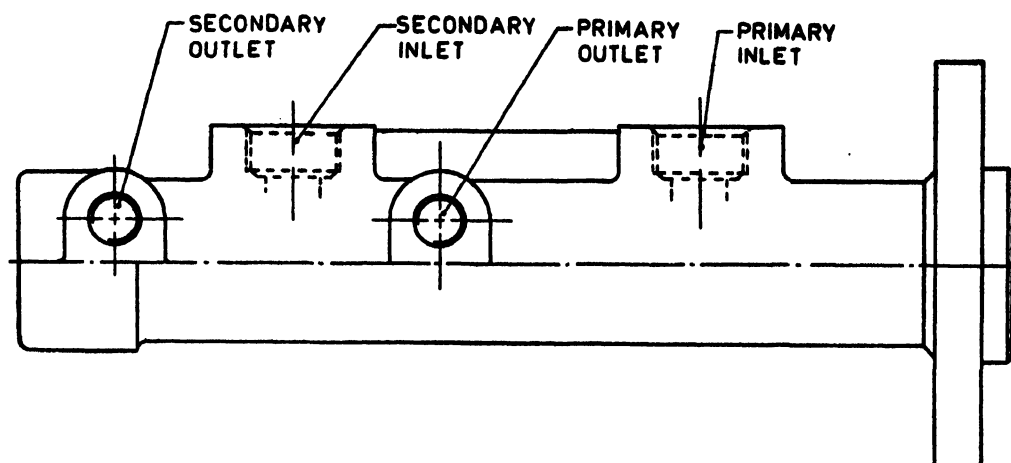


FIG. 2 MASTER CYLINDER NOMENCLATURE

5.2 The test arrangement are shown in Fig. 3.

6 TESTS

6.1 Full Stroke Test

6.1.1 Remove the protective plugs from the ports and then manually stroke the piston to full extent five times.

6.1.2 When tested as per 6.1.1 master cylinder assembly shall move smoothly throughout full design stroke after starting and completely

returned to its original position(s) on the fifth stroke within five seconds by the force of the piston return spring(s).

6.2 Venting Test

Venting test is carried on a complete master cylinder assembly.

6.2.1 Procedure

Install the master cylinder on the mounting plate and tighten mounting bolts. Make certain that the push-rod is aligned with the cylinder

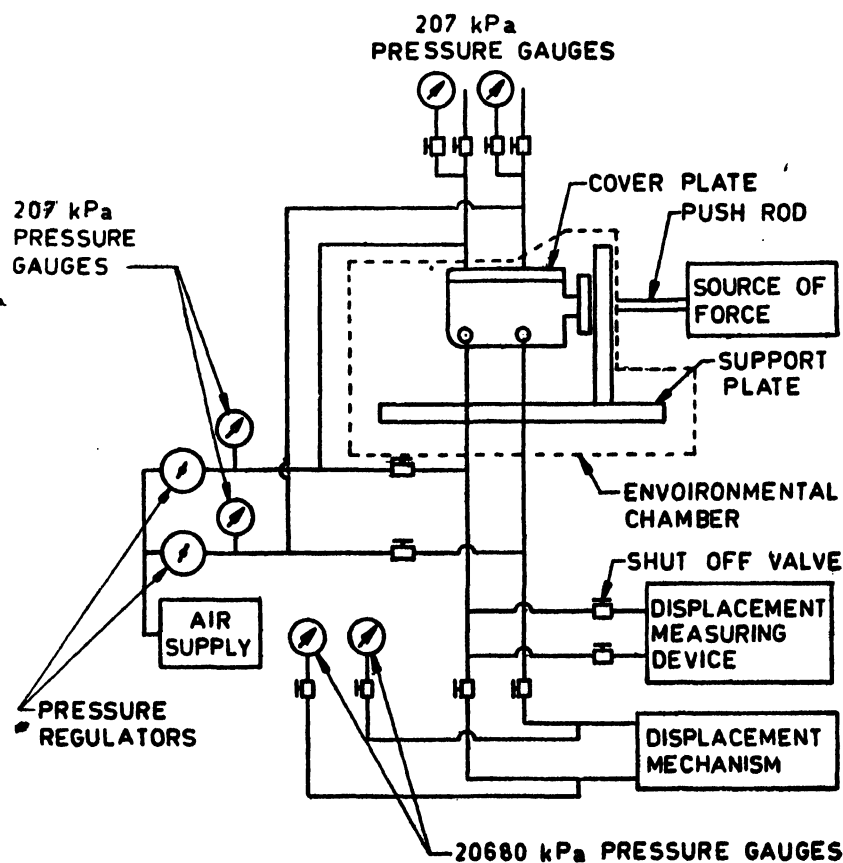


FIG. 3 TEST APPARATUS

bore axially. Adjust the push-rod to allow piston(s) to return to normal release position.

6.2.1.1 Connect a 210 ± 7 kPa air supply to the outlet ports. Bore venting will be indicated by the air flow from the vent port(s).

6.2.1.2 Without changing the setup in procedure 6.2.1.1, stroke the input pushrod a minimum of 5 mm. Apply 210 ± 7 kPa air pressure to the outlet port(s) and observe that no air is flowing from the vent port(s).

6.2.1.3 The cylinder bore(s) shall be vented to the reservoir(s) when the air supply is given to the outlet ports.

6.2.1.4 The cylinder bore shall not be vented to the reservoirs when the input pushrod is stroked 5 mm minimum.

6.3 Residual Pressure

Residual pressure to be carried out to check the functioning of the valves (for cylinder with residual check valves only).

6.3.1 Procedure

Release the push-rod to allow piston(s) to return to the normal release position.

6.3.1.1 Cap (both) reservoir(s), apply 210 ± 7 kPa maximum air through cap with outlet port(s) open.

6.3.1.2 Open (both) reservoir(s) and apply air pressure to outlet port(s) as specified in manufacturer's data for residual valve operation check.

6.3.2 After checking as per 6.3.1, with reservoirs capped, the air shall pressure flow through outlet ports.

6.3.3 With both reservoirs open and air pressure applied, the air shall flow through outlet ports into the reservoirs within maximum/minimum values specified by the manufacturer.

6.4 Applied Leakage Test

6.4.1 Procedure

Connect low pressure hydraulic gauge(s) at outlet port(s). Fill the test setup with new Automotive hydraulic brake fluid, heavy duty conforming to IS 8654 : 1986 to the manufacturers recommended level and bleed air from the master cylinder and gauge(s) by stroking until the existing fluid stream is free of air bubbles.

6.4.1.1 Apply master cylinder to build up 140 ± 14 kPa pressure. Hold push-rod in applied position(s) and observe gauge(s) for pressure drop.

6.4.1.2 Replace low pressure hydraulic gauge(s) with high pressure hydraulic gauge(s) and bleed gauge(s) with gauge bleeder screw(s) open ;

stroke piston(s) sufficiently for seal(s) to pass vent hole(s) ; restrain piston(s) and close bleeder screw(s). Allow the master cylinder to build up 6900 ± 690 kPa pressure. Hold push-rod in applied position(s) and observe gauge(s) for pressure drop.

6.4.2 With push-rod in applied position and pressure of 140 ± 14 kPa, there shall be no pressure drop in excess of 7 kPa after 30 ± 1 seconds interval.

6.4.3 With push-rod in position and 6900 ± 690 kPa pressure, the pressure drop shall not exceed 345 kPa after 30 ± 1 seconds interval.

6.5 Fluid Displacement

It is checked to calculate the discharge from outlets at the end of each stroke.

6.5.1 Procedure

Suitable fluid displacement measuring equipment shall be connected to cylinder outlet(s) with shut-off valve(s) between measuring equipment and outlet(s). The cylinder and equipment shall be bled of air before starting test measurements.

6.5.1.1 The cylinder shall be stroked to its full design stroke for five full applications at 2.5 mm/seconds maximum velocity with a minimum of 5 second interval between strokes. Close shut-off valve(s) at end of each application and while cylinder is being returned to release position. The fluid volume discharge from the outlet(s) at the end of each stroke shall be recorded. Calculate and record the average of all trials.

6.5.2 After checking as per 6.5.1 the average fluid volume discharge at the outlet ports per stroke shall comply with manufacturer's recommendations. The discharge difference at the outlets for any applications shall not be greater than five percent from the average.

6.6 Strength

Refers to the physical strength of the assembly to comply with drop in pressure, structural soundness and leakages.

6.6.1 Procedure

Connect high pressure hydraulic gauge(s) at outlet port(s). Fill the test set up with new Automotive hydraulic brake fluid, heavy duty conforming to IS 8654 : 1986 and bleed air from the master cylinder and gauge(s) by stroking until the existing fluid stream is free of air bubbles.

6.6.1.1 With gauge bleeder screw(s) open, stroke piston(s) sufficiently for seal(s) to pass vent hole(s), restrain piston(s) close bleed screw(s) and apply push-rod force to develop a test pressure of 25 000 kPa for 15 ± 5 seconds. Observe gauge(s) for an abrupt decline in pressure and master cylinder for fluid leakage.

6.6.2 The master cylinder assembly shall conform to the following:

- a) no abrupt decline in the pressure
- b) no sign of leakage
- c) no structural failure.

6.7 Humidity

Ability of the cylinder to operate under high humidity condition observed by the following test.

6.7.1 Procedure

Place stroking mechanism with master cylinder mounted and filled with Automotive hydraulic brake fluid, heavy duty conforming to IS 8654 : 1986 to the recommended level into the temperature — humidity cabinet. Connect the displacement mechanism(s) to the outlet port(s) of the cylinder, the system shall be bled and carefully dried of fluid. Set the stroking mechanism to cycle to $1\,000 \pm 100$ cycles/hour. Adjust the input force to the master cylinder and/or adjust the displacement mechanism(s) to stroke (each) master cylinder piston 60 to 80 percent of its full stroke at output pressures of $6\,900 \pm 690$ kPa. The rate of pressure rise versus travel shall fall within the shaded limits of Fig. 4. Stroke for 8 hours at $46.1 \pm 3^\circ\text{C}$ temperature and 80-90 percent relative humidity. Cease stroking for 16

hours while at room temperature and resultant relative humidity. Repeat this sequence.

Periodically observe master cylinder for fluid disturbance in the reservoir(s) as an indication of venting.

6.7.2 Remove master cylinder from humidity cabinet at the end of the second day (16 000 apply/release cycles and 32 hours static) and remove the brake fluid from the master cylinder. Carry out (unrestricted apply and release) test as per 6.1.

6.7.3 Re-install the pressure line(s) and carry out applied leakage test as per 6.4.1.1 and 6.4.1.2.

6.8 Corrosion Resistance

Corrosion resistance on storage is performed on a cylinder as per procedure outlined in 6.8.1.

6.8.1 Procedure

Fill the test set-up with new Automotive hydraulic brake fluid, heavy duty conforming to IS 8654 : 1986 to the manufacturer's recommended level and bleed air from the master cylinder by stroking until the existing fluid stream is free of air bubbles. With the master cylinder on its amounting plate piston(s) in released position, outlet(s) plugged, place empty

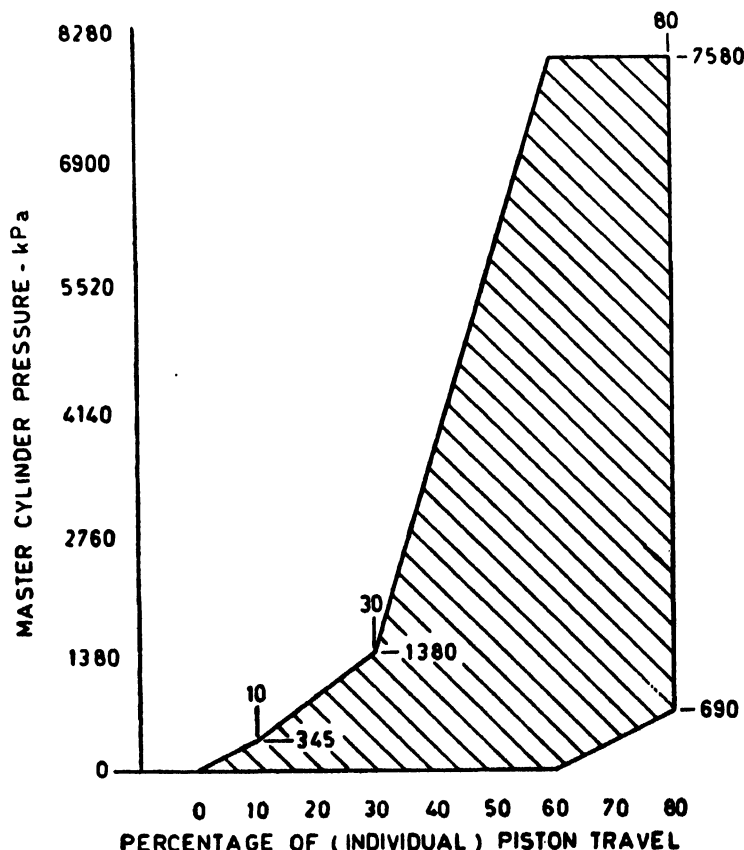


FIG. 4 RECOMMENDED STROKING PERFORMANCE CURVES

leak trap(s) under entrance to cylinder bore(s) and store cylinder for 7 days at room temperature.

6.8.2 At the end of 7 days, examine the cylinder for visible leakage.

6.8.3 Remove outlet plug(s) and internal bleeder loop(s). Gradually increase force on input rod until piston starts to move. Measure and record this force.

6.8.4 Flush out brake fluid from the master cylinder assembly and carryout full stroke test as per 6.1.1.

6.8.5 Re-install the pressure line(s) and carry out applied leakage test as per 6.4.1.1 and 6.4.1.2.

6.9 Reservoir Capacity and Leakage

Checking of reservoir is applicable for integral type of reservoir and is carried out as given in 6.8.1.

6.9.1 With the master cylinder located in design position remove all fluid from the reservoir(s) up to the level of the vent port opening(s). Using a graduated cylinder, refill reservoir(s) to minimum design level using new clean brake fluid and measure the amount(s) required.

6.9.2 The fluid volume required to fill the reservoirs up to minimum design level shall not be less than the fluid volume capacity recommended by the manufacturer.

6.9.3 When tested at 2.7 kg/cm² there shall be no visible leakage.

6.10 Heat Pressure Stroking (For Master Cylinder Rubber Cups)

When tested as per Annex G of IS 13225 : 1991 shall comply with following:

a) Lip diameter change

The minimum lip diameter of wheel cylinder cups after the stroking test shall

be greater than the wheel cylinder bore by the minimum dimensions as tabulated below.

<i>Wheel Cylinder Cups, Dia, mm</i>	<i>Excess Over Bore, mm</i>
Up to 25.4	0.508
Over 25.4 up to 38.1	0.635
Over 38.1 up to 50.8	0.762

b) Leakage

Constant dampness past the cups or fluid discoloration of the filter paper on two or more inspections shall be cause for rejection.

c) Change in hardness

Rubber cups shall not decrease in hardness by more than 15 deg IRH, or the primary and secondary master cylinder test cups shall not decrease in hardness by more than 15 deg IRH.

d) Condition of test cups

The primary and secondary cups shall not show excessive deterioration such as scoring, scuffing, blistering, cracking, chipping (heel abrasion), or change in shape from original appearance.

e) Corrosion

Piston and cylinder bore shall show no evidence of pitting on visual inspection. A slight discoloration or staining is permitted.

6.11 Low Temperature Performance (For Rubber Cups)

When tested as per Annex D of IS 13225 : 1991 no leakage of fluid shall occur on subjecting the test cups to a temperatures of — 40°C to 43°C for 22 hours, no cracking shall be observed and the cup shall return to its approximate original shape within one minute after the bend test.

Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publication), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference :

Doc : No. TED 4 (5399)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :

Telephone

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

{ 331 01 31
{ 331 13 75

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola
CALCUTTA 700054

37 86 62

Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036

53 38 43

Southern : C.I.T. Campus, IV Cross Road, MADRAS 600113

2350216

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)
BOMBAY 400093

6 32 92 95

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR.
COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI.
HYDERABAD. JAIPUR. KANPUR. PATNA. THIRUVANANTHAPURAM.